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10/670,894	09/24/2003	Liew Tong Sen	70030599-1	5998

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EXAMINER	
HUNG, YUBIN	

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2624	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/670,894	SEN ET AL.	
	Examiner	Art Unit	
	Yubin Hung	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21 and 23-29* is/are rejected.

7)☒ Claim(s) *6,10,14,17 and 22* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 September 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *4/4/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

3. Claim 1, and similarly claim 12, recites the limitation "said composite images" in line 8. Since "composite images" appear both in lines 3 and 6, it is not clear which one is being referred to, ambiguity arises and the mete and bound of the claim cannot be ascertained. Claims 2-11 and 13-18 are similarly rejected since they inherit the same ambiguity.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1, 7, 8, 19-21, 23, 24, 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Friend et al. ("Real-Time Wavelet Based Target Tracking," SPIE Vol. 3517, Nov. 1998, pp. 349-355), and further in view of Fuji et al. (US 2002/0057736).

6. Claim 19 is analyzed first.

Regarding claim 19, Friend discloses

- receiving an input image
  [P. 352, last three paragraphs. Note that the frame-by-frame capture and conversion of the images constituting the reception of input images one by one]
- decomposing said input image into a plurality of composite images that comprise different frequency bands of said input image
  [P. 352, last paragraph-P. 353, 1st two paragraphs]

While Friend discloses selecting features and use them for tracking targets in a sequences of frames (therefore can determine motion) [P. 354, last two paragraphs; see also the 2nd paragraph on P. 355]. Friend does not expressly disclose the following, but Fuji does:

- comparing said composite images with reference composite images to produce preliminary motion values for said different frequency bands
  [Fig. 3, ref. 12f and P. 3, paragraph 57 (compare with reference); P. 4, paragraph 67, lines 6-9 (produce preliminary motion values for all bands before the final one is determined)
- determining a final motion value from said preliminary motion values
  [Fuji: P. 4, paragraph 67, lines 6-9. Note that the preliminary motion value corresponding to the band that has the highest similarity is determined as the final motion value. Further note that the motion

vector is determined by matching (i.e., based on similarity), see Fig. 5 and paragraph 65, lines 8-19]

Friend and Fuji are combinable because they both have aspects that are from the same field of endeavor of motion estimation.

At the time of the invention it would have been obvious to one of ordinary skill in the art to modify Friend with the teaching of Fuji by determining a final motion value from a set of preliminary motion values. The motivation would have been to obtain the best estimate of the motion, since the decision (on which motion vector to use) is based on the highest similarity of block matching.

Therefore, it would have been obvious to combine Fuji with Friend to obtain the invention as specified in claim 19.

7. Regarding claim 1, note that Fuji discloses a device comprising a decompose logic [Fig. 3, ref. 12b], a storage coupled to the transform logic [Fig. 3, ref. 12h; P. 3, paragraph 56], a comparison logic [Fig. 3, ref. 12f] and a logic to determine a final motion value [Fig. 3, ref. 12f; also P. 4, paragraphs 65-67, especially lines 6-9 of paragraph 67]. Note further that per the analysis of claim 19, the recited functions are carried by the respective logics.

8. Regarding claims 7 and 23, per the analyses of claims 1 and 19 (their respective parent claims), the combined invention of Friend and Fuji further discloses modifying the

preliminary motion values wherein repetitive features are reduced. [See, especially, P. 4, paragraph 67, lines 6-9 of Fuji. Note that since the preliminary motion value corresponding to the band that has the highest similarity is determined as the final motion value, the preliminary motion values of the rest of the frequency bands are not incorporated (as they are modified or attenuated to zero) and therefore a repetitive feature (which may give rise to a preliminary motion value) whose frequency falls in a frequency band that is not the selected one is effectively reduced (because its corresponding motion value is not incorporated into the final motion value).]

9. Regarding claim 8, the combined invention of Friend and Fuji further discloses

- wherein said decompose logic comprises a plurality of filters having different frequency characteristics from each other
[Fuji: Fig. 9 and P. 6, paragraph 83, especially lines 5-7]

10. Regarding claim 20, note that both Friend [P. 353, 2nd paragraph] and Fuji [Figs. 4 & 9 and P. 6, paragraph 83] disclose recursive application of a discrete wavelet transform.

11. Regarding claim 21, note that Fig. 9 of Fuji further discloses sub-images (e.g., LH and HL, which are images themselves) resulted from the DWT decomposition having different frequency bands in the x- and the y-components.

12. Regarding claim 24, note that Fuji indicates the use of high-pass and low-pass filters (H_1 and H_0 for high- and low-pass, respectively) that have different frequency characteristics [Fig. 9 and P. 6, paragraph 83].

13. Claim 26 is rejected because per the analysis of claim 19, in the determination of the final motion value the value from the band with the highest similarity is selected [Fuji: P. 4, paragraph 67, lines 6-9]; this is equivalent to setting the weight for the selected value to 1 and the weights for the values from the remaining bands to 0.

14. Claim 27 is rejected because (per the analysis of claim 26) while the possible weight values are 0 or 1, the assignment of the weights (to the motion values from different bands) varies from image to image (because a band, say LH_2, in one image that produces the highest similarity may not be the same highest-similarity-value-producing band in another image); therefore the weighting values for the motion values from the bands are determined dynamically (i.e., changes from image to image).

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15. Claims 2-5, 9, 12-16 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Friend et al. ("Real-Time Wavelet Based Target Tracking," SPIE Vol. 3517, Nov. 1998, pp. 349-355) and Fuji et al. (US 2002/0057736) as applied to claims 1, 7, 8, 19-21, 23, 24, 26 and 27 above, and further in view of Kroos et al. (US 6,931,145).

16. Claim 12 is analyzed first:

Regarding claim 12, per the analysis of claim 1 Fuji discloses a decompose (or transform) logic [Fig. 3, ref. 12b], a storage coupled to the transform logic [Fig. 3, ref. 12h; P. 3, paragraph 56], a comparison logic [Fig. 3, ref. 12f] and a logic to determine a final motion value [Fig. 3, ref. 12f; also P. 4, paragraphs 65-67, especially lines 6-9 of paragraph 67]. Note further that per the analysis of claim 19, the recited functions are carried by the respective logics. The analysis of claim 19 (upon which the analysis of claim 1 is based) also provides the motivation to combine Friend and Fuji.

The combined invention of Friend and Fuji does not expressly discloses a sensor the following, which is disclosed by Kroos:

- an image sensor
  [Fig. 2, ref. 30; Col. 5, lines 31-32]

The combined invention of Friend and Fuji is combinable with Kroos because they both have aspects that are from the same field of endeavor of motion estimation.

At the time of the invention it would have been obvious to one of ordinary skill in the art to modify the combined invention of Friend and Fuji with the teaching of Kroos as recited above. The motivation for using an image sensor in the system would have been to be able to acquire image sequence for the task at hand, e.g., tracking, which is

what the invention of Friend is about. Note that it would also have been obvious to couple the sensor to the transform logic of Fuji [Fig. 3, ref. 12b] and the motivation would have been so that the acquired images can be processed (i.e., wavelet transformed for motion detection).

Therefore, it would have been obvious to combine Kroos with Friend and Fuji to obtain the invention as specified in claim 12.

17. Regarding claim 2, and similarly claim 13, Kroos further discloses

- said decompose (or, transform) logic performs a redundant Discrete Wavelet Transform
[Fig. 13; Col. 8, lines 10-21 (note that no sub-sampling is carried therefore the transform is redundant). Note that the motivation for using redundant DWT would have been because it provides shift invariance which would be beneficial if de-noising, smoothing or sharpening of edges are desired, as is well known in the art (e.g., see Col. 10, lines 8 of Berkner (US 7,068,851))]

18. Regarding claims 3-5, the combined invention of Friend, Fuji and Kroos further discloses decomposing an image in such a manner as to produce images of which the x- and the y-components comprise different (claim 3), both different and same (claim 4) and the same (claim 5) frequency bands [Kroos: Fig. 13 and Col. 8, lines 15; note that the x- and the y-components of each of the images labeled "Approximation" (commonly referred to as LL) have the same frequency band and for those labeled as "Subband" (commonly referred as LH or HL) the frequency bands are different.]

19. Regarding claim 9, and similarly claims 16 and 25, the combined invention of Friend, Fuji and Kroos further discloses

- wherein said comparison logic performs a cross-correlation on a subset of pixels between said composite images with said reference composite images
[Kroos: Fig. 7, ref. 154 (correlation); Col. 9, lines 58-61 (cross correlation using texture map, i.e., a subset of pixels); Col. 10, lines 30-42 (performed for each sub-band). Note that The motivation for using cross correlation would have been because for picture matching cross correlation is as form of minimum-error decision making, as is well known in the art (e.g., see P. 44, 2nd paragraph of Rosenfeld and Kak's *Digital Picture Processing*, 2nd ed., vol. 2, 1982)]

20. Regarding claim 15, per the analyses of its parent claim 12 the combined invention of Friend, Fuji and Kroos further discloses attenuating the preliminary motion values wherein repetitive features are reduced. [See, especially, P. 4, paragraph 67, lines 6-9 of Fuji. Note that since the preliminary motion value corresponding to the band that has the highest similarity is determined as the final motion value, the preliminary motion values of the rest of the frequency bands are not incorporated (i.e., attenuated to zero) and therefore a repetitive feature (which may give rise to a preliminary motion value) whose frequency falls in a frequency band that is not the selected one is effectively reduced (because its corresponding motion value is not incorporated into the final motion value).]

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21. Claims 11 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Friend et al. ("Real-Time Wavelet Based Target Tracking," SPIE Vol. 3517, Nov. 1998, pp. 349-355) and Fuji et al. (US 2002/0057736) as applied to claims 1, 7, 8, 19-

21, 23, 24, 26 and 27 above, and further in view of Zafar et al. ("Multiscale Video Representation Using Multiresolution Motion Compensation and Wavelet Decomposition," IEEE J. Selected Areas in Communications, V. 11, No. 1, Jan 1993, pp. 24-35).

22. Regarding claim 11, and similarly claim 28, the combined invention of Friend and Fuji discloses all limitations of its parent, claim 1.

The combined invention of Friend and Fuji does not expressly disclose the following, which is taught by Zafar

- wherein said decompose logic performs a quantization with a pre-determined threshold
  [P. 26, right column, lines 1-9, especially lines 8-9]

The combined invention of Friend and Fuji is combinable with Zafar because they both have aspects that are from the same field of endeavor of motion estimation.

At the time of the invention it would have been obvious to one of ordinary skill in the art to modify the combined invention of Friend and Fuji with the teaching of Zafar as recited above. The motivation would have been to reduce the number of coefficients to be further quantized as well as for the simplicity (when using a fixed, i.e., pre-determined, threshold), as Zafar indicates in lines 1-9 on the right column of page 26.

Therefore, it would have been obvious to combine Zafar with Friend and Fuji to obtain the invention as specified in claim 11.

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23. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Friend et al. ("Real-Time Wavelet Based Target Tracking," SPIE Vol. 3517, Nov. 1998, pp. 349-355), Fuji et al. (US 2002/0057736) and Kroos et al. (US 6,931,145) as applied to claims 2-5, 9, 12-16 and 25 above, and further in view of Zafar et al. ("Multiscale Video Representation Using Multiresolution Motion Compensation and Wavelet Decomposition," IEEE J. Selected Areas in Communications, V. 11, No. 1, Jan 1993, pp. 24-35).

The combined invention of Friend, Fuji and Kroos does not expressly disclose the following, which is taught by Zafar

- wherein said transform logic performs a quantization with a pre-determined threshold
[P. 26, right column, lines 1-9, especially lines 8-9]

The combined invention of Friend, Fuji and Kroos is combinable with Zafar because they both have aspects that are from the same field of endeavor of motion estimation.

At the time of the invention it would have been obvious to one of ordinary skill in the art to modify the combined invention of Friend, Fuji and Kroos with the teaching of Zafar as recited above. The motivation would have been to reduce the number of coefficients to

be further quantized as well as for the simplicity (when using a fixed, i.e., pre-determined, threshold), as Zafar indicates in lines 1-9 on the right column of page 26.

Therefore, it would have been obvious to combine Zafar with Friend, Fuji and Kroos to obtain the invention as specified in claim 18.

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24. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Friend et al. ("Real-Time Wavelet Based Target Tracking," SPIE Vol. 3517, Nov. 1998, pp. 349-355) and Fuji et al. (US 2002/0057736) as applied to claims 1, 7, 8, 19-21, 23, 24, 26 and 27 above, and further in view of Rovati et al. (US 7,099,512).

25. Regarding claim 29, the combined invention of Friend and Fuji discloses all limitations of its parent, claim 19.

The combined invention of Friend and Fuji does not expressly disclose performing the method of claim 19 in an optical mouse.

However, Rovati discloses an optical mouse with motion detection capability [Fig. 1; Col. 3, lines 37-55].

The combined invention of Friend and Fuji is combinable with Rovati because they both have aspects that are from the same field of endeavor of motion estimation.

At the time of the invention it would have been obvious to one of ordinary skill in the art to modify the combined invention of Friend and Fuji with the teaching of Rovati as recited above. The motivation would have been because for an optical mouse it is necessary to be able to determine the motion imparted by the user from the generated frames, as Rovati indicates in Col. 1, lines 13-27.

Therefore, it would have been obvious to combine Rovati with Friend and Fuji to obtain the invention as specified in claim 29.

Allowable Subject Matter

26. Claims 6, 10, 14, 17 and 22 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims and/or to overcome the rejections under 35 U.S.C. 112 second paragraph rejections set forth in this Office action.

27. The following is a statement of reasons for the indication of allowable subject matter:

A. Regarding claim 6, and similarly claim 22, closest art of record does not disclose all limitations. While Fuji discloses determining a final motion value by selecting the preliminary motion value of the band with the best matching result, it does not disclose, teach or suggest comparing the motion values *per se* from different frequency bands to determine differences based on features in the spatial domain (as reflected in the cross-correlation result, or, motion value as per P. 16, lines 8-21 of the instance application).

B. Regarding claim 10, and similarly claim 17, closest art of record does not disclose all limitations. While Fuji suggests representing motion in terms of the x- and the y-displacement [Fig. 5] and further discloses assigning weights to different frequency band [per the analysis of claim 27], it does not disclose, teach or suggest weighting the x- and the y-components of the motion differently.

C. Regarding claim 14, closest art of record does not disclose selectively filter repetitive features in the x- and the y-axis.

Conclusion and Contact Information

28. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

- Li et al. (US 2002/0186772) – discloses selecting pixels from a block of DWT coefficients for matching to determine motion [Fig. 3, ref. 68; Fig.6]
- Nozawa et al. (US 6,937,773) – discloses motion vector using the LL, HL2 and LH2 bands [Figs. 2B, 3, 4]
- Kotani et al. (US 6,795,578) discusses adverse effect of repeated pattern on motion detection [Col. 2, lines 34-37 & 50-52]
- Edic et al. (US 2004/0136490) – discloses using wavelet to detect motion in CT imagery [Fig. 8; P. 6, paragraph 59]
- Toyokura et al. ("Wavelet Coefficients Motion Compensation for Image Sequence Encoding," IEEE Conf. Circuits and Systems, 24-27 Nov 1998, pp. 53-56) – discloses motion detection by matching a vector formed by selecting a total of 64 pixels from all bands; the previous image is transformed using redundant DWT
- DeVore et al. ("Motion Estimation with the Redundant Wavelet Transform," IEEE Int'l Workshop on Digital and Computational Video, Nov 2002, pp. 53-58) – discloses motion detection using redundant DWT on the reference frame and regular DWT (i.e., down-sampled) on the target frame

29. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yubin Hung whose telephone number is (571) 272-7451. The examiner can normally be reached on 7:30 - 4:00. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew C. Bella

can be reached on (571) 272-7778. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

30. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

06/08/07

Yubin Hung
Patent Examiner
Art Unit 2624
June 8, 2007